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A Lifestyle Communication Tool: Association of E-cigarette Use and Pre-diabetes

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The aim of this study was to present a framework for clinicians to use when discussing electronic cigarette (e-cigarette) use and its association with pre-diabetes. A communication tool was designed using evidence-based strategies from the academic literature. A four-step framework is presented, which includes: step (1) helping patients to understand the association between e-cigarette use and pre-diabetes; step (2) the synergistic health impacts of e-cigarette use and pre-diabetes; step (3) management of diabetes-related lifestyle factors; and step (4) stages of change assessment related to e-cigarette reduction. This communication tool provides support for clinicians to discuss the risk of pre-diabetes associated with e-cigarette use. Moving forward, implementation and evaluation of this model are needed.

Key words: Electronic cigarettes, Public health, Pre-diabetes, Communication tool, Clinical tool, Risk communication

INTRODUCTION

Electronic cigarette (e-cigarette) use has increased in popularity in recent years, and it is necessary to implement a multifaceted approach to curb the use of these products [1]. This may include public policy enactment, dissemination of evidence-based information through academic journals, and providing support to clinicians [1]. This paper aims to provide support to clinicians through a 4-step communication tool when discussing one of the risks associated with the use of e-

cigarettes, specifically pre-diabetes.

The population prevalence of pre-diabetes is very high. In the United States, an estimated 34.5% of adults over the age of 18 meet the criteria for pre-diabetes [2].

Recent studies by Zhang et al. [3] and Atuegwu et al. [4] demonstrated an association between e-cigarette use and pre-diabetes. Both studies used data from the Behavioral Risk Factor Surveillance System survey; specifically, Zhang et al. [3] considered data from 2016-2018, while Atuegwu et al. [4] assessed 2017 data. Data from these studies support the idea that focusing our efforts on e-cigarette use reduction and cessation among users is worthwhile for reducing their pre-diabetes risk. Zhang et al. [3] recommend employing a therapeutic lifestyle management strategy, which includes educating e-cigarette users to reduce their use. Building on these recommendations, we propose a 4-step communication tool (Table 1) that clinicians can follow to educate and motivate their patients towards e-cigarette use reduction and cessation.

Table 1. The objectives of each step of the communication tool

Step	Objective
1	Helping patients to understand the association between e-cigarette use and pre-diabetes
2	Synergistic health impacts of e-cigarette use and pre-diabetes
3	Management of diabetes-related lifestyle factors
4	Stages of change assessment related to smoking reduction and cessation

e-cigarette, electronic cigarette.

COMMUNICATION TOOL

Step 1: Helping Patients to Understand the Association Between Electronic-cigarette Use and Pre-diabetes

In this step, clinicians explain how e-cigarette use could increase their patient's risk for pre-diabetes. Zhang et al. [3] found that people who currently use e-cigarettes have a higher risk for pre-diabetes than non-users (odds ratio [OR], 1.54; 95% confidence interval [CI], 1.17 to 2.04), and former e-cigarette users who have discontinued use may have a relative reduction in their previously elevated risk for pre-diabetes (OR, 1.13; 95% CI, 1.00 to 1.29). Atuegwu et al. [4] found that current users of e-cigarettes had a higher risk (OR, 1.97; 95% CI, 1.25 to 3.10) of reporting pre-diabetes than non-users.

The exact mechanisms connecting e-cigarette use and pre-diabetes remain unclear; however, research has shown that nicotine disrupts glucose homeostasis, increases blood glucose levels, and contributes to inflammation and obesity [3]. It is critical to educate users about their elevated risk for pre-diabetes associated with e-cigarette use and the significant negative impact diabetes can have on an individual's health.

Further, it is necessary to probe into the use of combustible cigarettes, as some e-cigarette users may simultaneously be using combustible cigarettes, which have also been strongly linked with pre-diabetes [5]. Overall, a detailed social history is important so that clinicians can target their discussions to a patients' unique medical, smoking, and lifestyle history.

Step 2: Synergistic Health Impacts of Electronic-cigarette Use and Pre-diabetes

In this step, clinicians discuss the negative health consequences of pre-diabetes for their patients and how e-cigarette use can further complicate their existing health conditions or increase their risks of other diseases. Individuals with pre-diabe-

tes are at risk for developing macrovascular (cerebrovascular disease, myocardial infarction, peripheral artery disease) and microvascular (nephropathy, retinopathy, neuropathy) complications associated with diabetes [6]. E-cigarette use has also been shown to worsen diseases related to the respiratory system [7]. In recent times, given the context of the coronavirus disease 2019 (COVID-19) pandemic, an example of a respiratory complication is e-cigarette or vaping-associated lung injury, which may be misdiagnosed as pulmonary complications due to COVID-19 infection [7].

The potential synergistic health impacts on cardiovascular health, among other organ systems, should be proactively discussed with patients, especially given the misinformation that may be present surrounding e-cigarette use [1]. Moreover, given the amount of misinformation present, clinicians may need to patiently elicit and understand patients' perspectives on the risks associated with e-cigarette use. Healthcare professionals, such as physicians, are trusted sources of information and are positioned to provide understandable, evidence-based information to their patients in a clear and concise way.

Step 3: Management of Diabetes-related Lifestyle Factors

In this step, we recommend clinicians follow the American Diabetes Association Standards of Diabetes care guidelines in conjunction with the encouragement of e-cigarette use reduction or cessation to promote an individualized, long-term, and self-guided treatment approach with appropriate lifestyle modifications associated with improved glycemic control [8].

Moreover, these specific lifestyle modifications can include advising patients to make changes to their diet and physical activity. A systematic review and meta-analysis [9] found that lifestyle modifications are a safe and effective way to reduce the progression of pre-diabetes to type 2 diabetes. Additionally, it was found that those with pre-diabetes who engaged in lifestyle interventions were more likely to report better quality of life. On a broader systemic level, encouraging lifestyle changes to prevent progression to diabetes is also cost-effective for the public health medical system. Healthcare professionals can collaborate with other members of the healthcare team, such as dieticians and physiotherapists, to provide individualized and evidence-based support for patients to make lifestyle changes. It is also important to consider the patient's cultural background, beliefs, and attitudes to ensure adherence to and success of this treatment program.

Step 4: Stages of Change Assessment Related to Smoking Reduction and Cessation

In the last step of the 4-step communication tool, clinicians should understand that achieving the target of smoking reduction and cessation requires a stages of change assessment to motivate their patients to change and to ensure that appropriate, attainable, and timely goals are set. The stages of change include five main stages—specifically, the pre-contemplation, contemplation, preparation, action, and maintenance/relapse prevention stages [10]. In the pre-contemplation stage, patients are not actively considering making changes to their e-cigarette use behavior. While in the contemplation stage, patients are aware of the need to change their behavior but are undecided on taking action to make these changes to their e-cigarette use. In the preparation stage, patients intend to take action regarding their e-cigarette use. During the action stage, patients make concrete efforts to practice the desired behavior. Finally, in the maintenance/relapse prevention stage, patients work to sustain current changes in e-cigarette use or fail to do so, and some may relapse and return to their baseline e-cigarette use behavior. We suggest clinicians follow the stages of change model proposed by Zimmerman et al. [10] when discussing smoking cessation with their patients. Further, clinicians may consider using motivational interviewing strategies when discussing the stages of change with their patients, especially when helping patients progress to the next stage of change [10].

CONCLUSION

Our 4-step communication tool incorporates evidence-based information and methodology for clinicians to utilize when trying to achieve a therapeutic lifestyle management strategy, as proposed by Zhang et al. [3]. Step 1 includes discussing the associations of e-cigarette use with pre-diabetes, step 2 involves discussing the negative synergistic impacts on health that both e-cigarette use and pre-diabetes have, step 3 entails appropriately managing lifestyle risk factors, and step 4 includes assessing the patient's personal stage of change. Thus, this paper provides a preliminary communication tool that clinicians can use when discussing the association between e-cigarette use and pre-diabetes with patients. Future research can evaluate the proposed communication tool.

Ethics Statement

This study did not involve human participants therefore institutional review board approval was not sought.

CONFLICT OF INTEREST

The authors have no conflicts of interest associated with the material presented in this paper.

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AUTHOR CONTRIBUTIONS

Conceptualization: Bandara NA, Vallani T. Data curation: Bandara NA, Vallani T. Formal analysis: Mannas M, Herath J. Funding acquisition: None. Methodology: Bandara NA, Vallani T, Zhou XR, Palihawadane SH, Gamage R, Mannas M, Herath J. Project administration: Mannas M, Herath J. Visualization: Bandara NA, Vallani T, Zhou XR, Palihawadane SH, Gamage R, Mannas M, Herath J. Writing – original draft: Bandara NA, Vallani T, Zhou XR, Palihawadane SH, Gamage R, Mannas M, Herath J. Writing – review & editing: Bandara NA, Vallani T, Zhou XR, Palihawadane SH, Gamage R, Mannas M, Herath J.

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